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Amphipoda species found in Lake Balaton since 1897

by
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Abstract: Since the first publication on Amphipoda in Lake Balaton (1897) altogether 8 species were found in different habitats of the lake. The species composition changed from time to time. In the 1980s 3 pontocaspian amphipods (*Corophium curvispinum, Dikerogammarus haemobaphes* and *D. villosus*) were found on the submerged macrophytes and on the stones of the littoral zone. We studied the life history and measured the biomass of *C. curvispinum* and *D. haemobaphes* on the submerged macrophyte *Myriophyllum spicatum* near Tihany peninsula. Both amphipods reproduce from May (*C. curvispinum* till October, *D. haemobaphes* till the middle of August). They produce two generations in a year. Biomass of *C. curvispinum* and *D. haemobaphes* was roughly 11 and 0.1 g animal dry wt per m, respectively, in an area covered by *M. spicatum* in August 1986.
Key words: Amphipoda, Lake Balaton, *Corophium*, *Dikerogammarus*, biomass

Amphipods play an important role in water ecosystems as utilizers of organic matter and as food for fish. At the same time, they react sensitively to changes in the environment. The first data on the occurrence of amphipods in Lake Balaton are from the last century (Table 1). Information was published on one of the species (*Gammarus pulex*) of the littoral zone. In the 1930s a pontocaspian species, *Corophium curvispinum*, appeared in the lake and rapidly invaded almost all of its habitats. This species might come from the Danube through the Sió canal, as they are building their tubes on the surface of water vessels (Sebestyén 1934, Entz 1943). In addition to this species, *Gammarus roeseli* appeared in the lake between the 1930s and 1950s.

Species composition of amphipods of Lake Balaton changed considerably at the beginning of the 1950s, when *Gammarus roeseli* was replaced by pontocaspian *Dikerogammarus* species (*D. haemobaphes* and *D. villosus*). It is possible that the *Dikerogammarus* species came into the lake with *Limnomysis benedeni*, which was introduced into the lake as fish food (Woynárovich 1954). The *Dikerogammarus* species have been permanent elements of amphipod fauna in the lake. The spreading of pontocaspian amphipods in Lake Balaton was probably possible because of their ability to utilize the high detritus content of the lake water as filtering organisms (Entz 1943, 1949, Ponyi 1955, 1956a). Another reason for the presence of these species in Lake Balaton might be that *D. villosus* has a higher tolerance to high water temperature than does *G. roeseli*, which is basically a river inhabitant (Lukacsovics 1958).

In addition to the above mentioned amphipods *Synurella ambulans* and *Niphargus mediodanubialis* has been found in Lake Balaton (in the marshy zone of the reed belt, close to the shore) (Ponyi 1962). I should mention here that my description of the amphipod species follows the "Limnofauna Europaea" (Pinkster 1978), disregarding the description of subspecies.

Table 1. Amphipoda species found in Lake Balaton

Species	Date of publication	Author
Gammarus pulex	1897, 1900	Daday
Synurella ambulans	1927	Dudich
	1962	Ponyi
Corophium curvispium	1934	Sebestyén, Moon
	1940, 1942, 1946	Entz & Sebestyén
	1941, 1947	Dudich
	1943, 1947, 1949	Entz
	1949-50	Stiller
	1956b, 1957	Ponyi
	1962, 1957	Sebestyén
	1962	Straskraba
	1971	Ponyi *et al.*
	1974	Bíró & Gulyás
	1986, 1989, 1990	Muskó
Corophium sowinskyi	1962	Straskraba
Corophium	1941	Varga
Gammarus roeseli	1934	Moon
	1940, 1942, 1946	Entz & Sebestyén
	1941	Mann, Stiller, Dudich
	1949-50	Stiller
	1954	Entz *et al.*
	1957	Stiller
Dikerogammarus villosus	1954	Entz *et al.*
	1955, 1956a, b,	Ponyi
	1961, 1957	Stiller
	1958	Lukacsovics
	1966	Zánkai
	1974	Bíró & Gulyás
	1986, 1989, 1990	Muskó
Dikerogammarus sp.	1971	Ponyi *et al.*
Dikerogammarus haemobaphes	1955, 1956a, b,	Ponyi
	1957, 1958, 1961,	
	1962, 1966, 1962	Straskraba
	1986, 1989, 1990	Muskó
Niphargus mediodanubialis	1941	Dudich
	1962	Ponyi

Samples were collected from submerged macrophytes (*Myriophyllum spicatum* and *Potamogeton perfoliatus*) as well as from the littoral stones near the macrophyte stands around the Tihany peninsula in August 1983 and in August 1986. We found that *C. curvispinum* was the dominant amphipod at each sampling site; the dominance was more expressed on the macrophyte stands than on the surface of the stones (Fig. 1). Moreover, *D. haemobaphes* and *D. villosus* were present in the samples. There was no significant difference between the amphipod population of the two macrophytes investigated.

In August 1986 we collected amphipod samples from the dominant macrophyte of 10 shoreline stands around Lake Balaton. On nine stands *P. perfoliatus* was the dominant submerged macrophyte; on the stand near Keszthely *M. spicatum* dominated. *C. curvispinum* was the dominant amphipod on each stand; their proportion exceeded 90% of the amphipods. *D. haemobaphes* and *D. villosus* also occurred in the samples. The abundance of amphipods at Keszthely was much

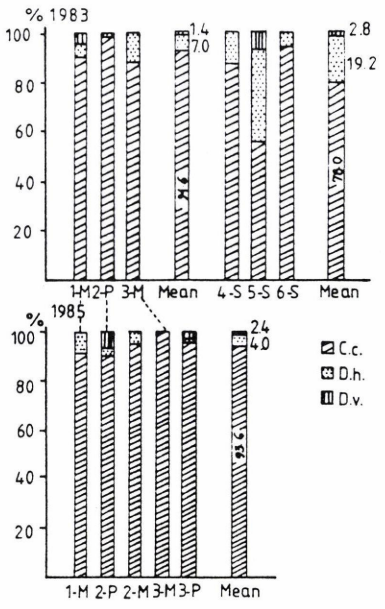

Fig. 1. Percentage distribution of the three amphipod species at the different stations in 1893 and 1895. C. c. = *Corophium curvispinum*, D. h. = *Dikerogammarus haemobaphes*, M = *Myriophyllum spicatum*, P = *Potamogeton perfoliatus*, S = stony shore zone, 1, 2, 3 = same sampling stands in both years. the 4th sampling stand of the stony shore was near to the 1st sampling stand of macrovegetation, the 5th sampling stand of stony shore near to the 2nd sampling stand of macrovegetation, while the 6th of the stony shore was near to the 3rd sampling stand of macrovegetation, all of them situated on the eastern side of the Tihany peninsula

lower than at the rest of the stands (5 in Keszthely, the maximum being 574 at Balatonmária) (Fig. 2).

In order to study the life history of amphipods, we collected fortnightly samples from *M. spicatum* in the Bozsai-Bay (beside the Tihany peninsula) from May till December 1986 and from July to the end of August in 1987. In 1987 we did not find any submerged macrophytes in the lake either in May or in June because of the cold weather during spring that year. Egg bearing females of *C. curvispinum* were present in the population from May to the end of October, and those of *D.*

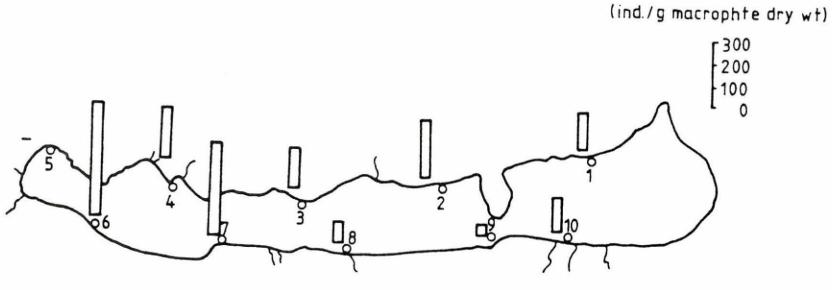

Fig. 2. Abundance of amphipods in ind./g macrophyte dry weight on the different sampling stands. 1 = Alsóörs, 2 = Balatonudvari, 3 = Révfülöp, 4 = Szigliget, 5 = Keszthely, 6 = Balatonmária, 7 = Fonyód, 8 = Boglárlelle, 9 = Szántód, 10 = Zamárdi

heamobaphes were present from May to middle of August. Because of the small amount of *D. villosus* in the samples, we were not able to evaluate the data. The juveniles of the *C. curvispinum* and *D. haemobaphes* species hatched in the spring, reached maturity and produced offspring in the summer of the same year, while the summer and autumn generation reproduced next year. The abundance and biomass of the latter two species decreased in the middle of summer, while they showed high values in autumn (Fig. 3). The reason might be partly the predation of fish or other organisms on the amphipods in the lake and partly the vigorous growth of the macrophytes in the summer months.

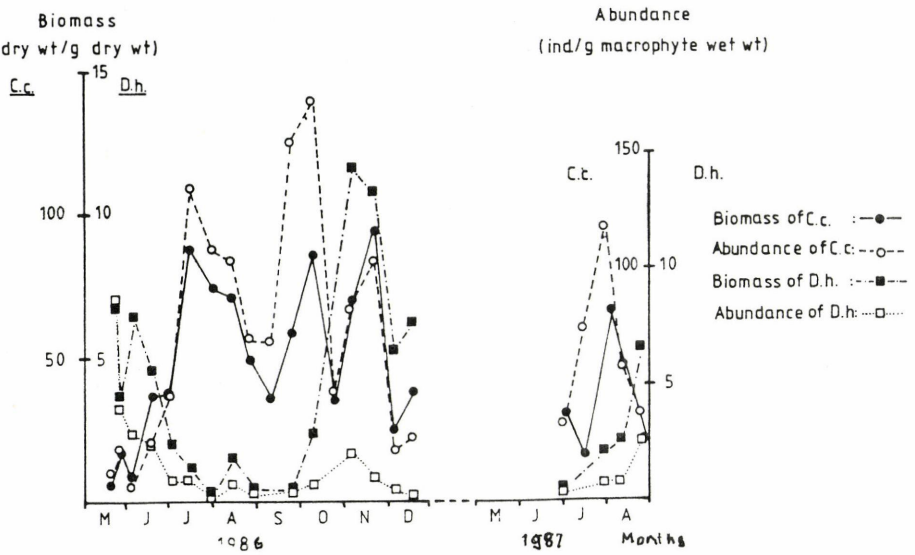

Fig. 3. Abundance and biomass of *C. corophium* and *D. haemobaphes* at different times of sampling

Taking into account the data of Varga & Tóth (1986) concerning the biomass of submerged macrophytes in Lake Balaton, we could roughly estimate the biomass of *C. curvispinum* and *D. haemobaphes*: 11 and 0.1 g animal dry weight/m respectively in August 1986 near the Tihany peninsula where the water was covered by *M. spicatum*.

We can conclude that the present-day species composition of amphipods in the sampled areas of Lake Balaton is very similar to the species composition recorded during the 60s, three pontocaspian amphipod species do occur in the lake and *C. curvispinum* is the dominant species.

Summary

1. There were only few amphipod species simultaneously present in Lake Balaton, the species composition changed from time to time. *Gammarus pulex* was found in the lake in the last century, while in the 1930s years *G. roeseli* and the pontocaspian *Corophium curvispinum* were present. Since the 1950s *G. roeseli* disappeared and pontocaspian *Dikerogammarus* species (*D. haemobaphes* and *D. villosus*) appeared in the littoral zone of Lake Balaton.

2. The reed belt was the richest in amphipod species. Beside the three ponto-caspian amphipods mentioned *Synurella ambulans* and *Niphargus mediodanubialis* were found there in the 1950-60s.

3. Since the 1950s the species composition of amphipods did not change on submerged macrophytes and in the stony littoral zone.

4. *C. curvispinum* and *D. haemobaphes* reproduce on submerged macrophyte in late spring, summer and early autumn. They produce two generations in a year. Their biomass was roughly 11 and 0.1 g animal dry wt/m, respectively, in an area covered by *M. spicatum* in August 1986.

Bibliography

Bíró, K. & Gulyás, P. (1974): Zoological investigations in the open water *Potamogeton perfoliatus* stands of Lake Balaton. – *Annal. Biol. Tihany* **41**: 181-203.

Daday, J. (1897): Rákfélék. Crustacea – In: Entz, G. (szerk.) A Balaton tudományos tanulmányozásának eredményei. Vol. 2 part 1. A Balaton faunája. (Wissenschaftliche Erforschung des Balatonsees. Bd. 2, Teil 1. Die Fauna des Balatonsees) Kiadja a Magyar Földrajzi Társaság Balaton-bizottsága. pp. 163-193.

Daday, J. (1900): Crustacea. – *Fauna Regni Hungariae* Vol. III. pp. 12.

Dudich, E. (1927): Új rákfajok Magyarország faunájában. (Neue Krebstiere in der Fauna Ungarns). – *Arch. Bal.* **1(3)**: 343-387.

Dudich, E. (1941): Nachträge und Berichtigungen zum Crustaceen-Teil des ungarischen Faunenkataloges. – *Fragm. Faun. Hung.* **4(1-4)**: 30-33.

Dudich, E. (1947): Die höheren Krebse (Malacostraca) der Mittel-Donau. – *Fragm. Faun. Hung.* **10**: 125-132.

Entz, B. (1943): Adatok a magyarországi *Corophium curvispinum* G.O.Sars forma *devium* Wundsch alaktanához és biológiájához (Beiträge zur Kenntnis der Morphologie und Biologie des *Corophium curvispinum* G. O. Sars forma *devium* Wundsch). – *M. Biol. Kut. Int. Munk.* **15**: 3-41.

Entz, B. (1947): Qualitative and quantitative studies in the coatings of *Potamogeton perfoliatus* and *Myriophyllum spicatum* in Lake Balaton. – *M. Biol. Kut. Int. Munk.* **17**: 17-37.

Entz, B. (1949): Beitrag zur Kenntnis der Morphologie und Biologie des *Corophium curvispinum* G. O. Sars forma *devium* Wundsch in Ungarn. – *Arch. Hydrobiol.* **42**: 423-469.

Entz, B., Kol, E., Sebestyén, O., R. Stiller, J., Tamás, G. & Varga, L. (1954): A Balatonba ömlő vizek fiziográfiai és biológiai vizsgálata. I. A Pécsely-patak (Physiographical and biological investigation on the waters flowing into Lake Balaton. I. The Pécsely brook). – *Annal. Biol. Tihany* **22**: 61-183.

Entz G., & Sebestyén, O. (1940): A Balaton élete. Das Leben des Balaton-Sees. – *M. Biol. Kut. Int. Munk.* **12**: 1-168.

Entz G., & Sebestyén, O. (1942): *A Balaton élete. Das Leben des Balaton-Sees.* – Magyar Term.tud. Társ. 366 pp.

Entz G., & Sebestyén, O. (1946): Das Leben des Balaton-Sees . – *M. Biol. Kut. Int. Munk.* **16**: 179-411.

Lukacsovics, F. (1958): Összehasonlító oxigénfogyasztási vizsgálatok állló- és folyóvízi Amphipodákon (*Dicerogammarus villosus bispinosus*, *Gammarus roeseli*). (Vergleichende Untersuchungen über den Sauerstoffverbrauch von Amphipoden aus stehenden und fliessenden Gewässern). – *Annal. Biol. Tihany* **25**: 57-67.

Mann, H. (1941): Über das Vorkommen von *Polymorphus minutus* (Gze.) (Acanth.) in der Umgebung von Tihany. – *M. Biol. Kut. Int. Munk.* **13**: 166-167.

Moon, H. P. (1934): A quantitative survey of the Balaton mud fauna. – *Arch. Ungar. Biol. Forsch.-Inst.* **7**: 170-189.

Muskó, I. B. (1986): Qualitative and quantitative studies on the Amphipoda in Lake Balaton. – *BFB-Bericht* **58**: 61-65.

Muskó, I. B. (1989): Amphipoda (Crustacea) in the littoral zone of Lake Balaton (Hungary). Qualitative and quantitative studies. – *Int. Revue ges. Hydrobiol.* **74**: 195-205.

Muskó, I. B. (1990): Qualitative and quantitative relationships of Amphipoda (Crustacea) living on macrophytes in Lake Balaton. – *Hydrobiologia* **191**: 269-274.

Pinkster, S. (1978): Amphipoda. – In: Illies, J. (ed.): *Limnofauna Europaea* – Gustav Fischer Verlag Stuttgart, New York Swets Zeitlinger B. V. Amsterdam pp. 244-253.

Ponyi, J. (1955): Ökológiai és táplálkozásbiológiai vizsgálatok a Gammarusok köréből (Ökologische und ernährungsbiologische Untersuchungen an verschiedenen *Gammarus*-Arten). – *Állatt. Közl.* **45**:75-90.

Ponyi, J. E. (1956a): Ökologische, ernährungsbiologische und systematische Untersuchungen an verschiedenen *Gammarus*-Arten. – *Arch. Hydrobiol.* **52**: 367-387.

Ponyi, J. (1956b): A balatoni hínárosok Crustaceáinak vizsgálata (Untersuchungen an Crustaceen in Tanggebilden des Balatons). – *Állat. Közl.* **45**: 107-121.

Ponyi, J. E. (1957): Untersuchungen über die Crustaceen der Wasserpflanzbestände im Plattensee. – *Arch. Hydrobiol.* **53**: 537-551.

Ponyi, J. E. (1958): Neuere systematische Untersuchungen an den ungarischen *Dicerogammarus*-Arten. – *Arch. Hydrobiol.* **54**: 488-496.

Ponyi, J. E. (1961): Über die Ernährung einiger Amphipoden (Crustacea) in Ungarn. – *Annal. Biol. Tihany* **28**: 117-123.

Ponyi, J. E. (1962): Zoologische Untersuchung der Röhrichte des Balaton I. Krebse (Crustacea). – *Annal. Biol. Tihany* **29**: 129-163.

Ponyi, J. (1966): A rákok (Crustacea) emésztőrendszerének fehérjebontó enzimeiről (Über die eiweisszersetzenden Enzyme des Verdauungssystems der Krebse (Crustacea). – *Állat. Közl.* **53**: 115-122.

Ponyi, J. E., Oláh, J., Bíró, P. & Bíró, K. (1971): Comparative investigations on the benthic fauna at two sewage inflows of Lake Balaton. – *Annal. Biol. Tihany* **38**: 199-226.

Sebestyén, O. (1934): A vándorkagyló (*Dreissensia polymorpha* Pall.) és a szövőbolharák (*Corophium curvispinum* G. O. Sars forma *devium* Wundsch) megjelenése és rohamos térfoglalása a Balatonban (Appearance and rapid increase of *Dreissensia polymorpha* Pall. and *Corophium curvispinum* G. O. Sars forma *devium* Wundsch in Lake Balaton). – *M. Biol. Kut. Int. Munk.* **7**: 190-204.

Sebestyén, O. (1957): Parti tanulmány (Study on organic sediment in the erosion-littoral of Lake Balaton). – *Ann. Biol. Tihany* **24**: 165-181.

Stiller, J. (1941): Epizoische Peritrichen aus dem Balaton-See I. – *Arb. Ung. Biol. Forsch.-Inst.* **13**: 211-223.

Stiller, J. (1949–50): Epizoische Peritrichen aus dem Balaton-See II. – *Ann. Inst. Biol. Pervest. Hung. Tihany* **19**: 15-37.

Stiller, J. R. (1957): Zur Biologie und Verbreitung der Protozoen- und Crustaceenfauna eines Mittelgebirgsbaches in Ungarn. – *Arch. Hydrobiol.* **53**: 392-424.

Straskraba, M. (1962): Amphipoden der Tschechoslowakei nach den Sammlungen von Prof. Hrabe I. – *Vestnik Ceskoslovenské spolecnosti zoologické* **26(2)**: 117-145.

Varga, Gy. & Tőth, L. (1986): A Balaton hínárállományának vizsgálata légifelvételek alapján 1983-1985 között. (Study of reed-grass stock in Lake Balaton with the aid of air-photos between 1983 and 1985). – *Magyar Hidrol. Társ. VI. Orsz. Vándorgy., Hévíz* 1986: 610-619.

Varga, L. (1941): Adatok a Balaton-part Cladophora-szövedékében élő állatok ismeretéhez (Beiträge zur Kenntnis der Fauna des Cladophora-Bewuchses des Balatonsees). – *M. Biol. Kut. Int. Munk.* **13**: 278-299.

Woynárovich E. (1954): Vorkommen der *Limnomysis benedeni* Czern. im ungarischen Donauabschnitt. – *Acta zool. hung.* **1**: 177-185.

Zánkai, N. P. (1966): On the pH conditions of the alimentary canals of some crustaceans. – *Annal. Biol. Tihany* **33**: 217-231.

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